$$\omega_r^2 = \omega_0^2 - \frac{h^2}{2m^2} > 0 \Rightarrow \frac{h^2}{2m^2} < \omega_0^2 = \frac{k}{m}$$

$$\Rightarrow h^2 < 2mk \Rightarrow h < \sqrt{2mk} = h_{limite}$$

$$h_{limite} = \sqrt{2\text{-}0{,}1.90} = 4{,}24SI$$

3°)

a- $ma + hv + kx = F$

$$\Rightarrow \frac{mdv}{dt} + hv + k\int vdt = F$$

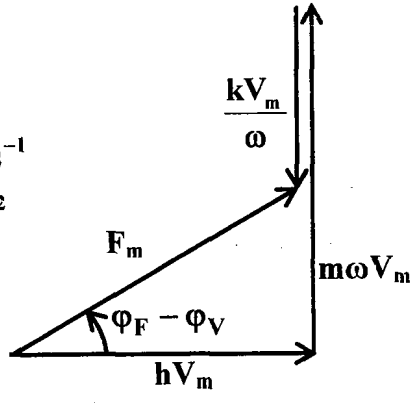
Par analogie

$$\Rightarrow \frac{Ldi}{dt} + Ri + \frac{1}{C}\int idt = U$$

$\omega = 40\ rads^{-1} > \omega_0 = 30 rads^{-1}$

$$F_m^2 = h^2V_m^2 + \left(m\omega v_m - \frac{kV_m}{\omega}\right)^2$$

$$= V_m^2\left(h^2 + \left(m\omega - \frac{k}{\omega}\right)^2\right)$$



$$V_m = \frac{F_m}{\sqrt{h^2 + \left(m\omega - \frac{k}{\omega}\right)^2}} = \frac{4{,}5}{\sqrt{0{,}25 + (4 - 2{,}25)^2}}$$

$V_m = 2{,}47 ms^{-1}$

$$tg(\varphi_F - \varphi_V) = \frac{m\omega - \frac{k}{\omega}}{h} = \frac{4 - 2{,}25}{0{,}5} = 3{,}5$$

$\varphi_F - \varphi_V = 1{,}29 rad$

$\varphi_V = -1{,}29 rad$

$V(t) = 2{,}47\sin(40t - 1{,}29)$ en ms^{-1}

$x(t) = \int vdt$

$$x(t) = \frac{2{,}47}{40}\sin\left(40t - 1{,}29 - \frac{\pi}{2}\right) \text{ en } m$$

$$= 6{,}18.10^{-2}\sin(40t - 2{,}86)$$

$$V_m = X_m\omega \text{ et } \varphi_V = \varphi_x + \frac{\pi}{2}$$

$$c - V_{max} = \frac{F_m}{\sqrt{h^2 + (m\omega - \frac{k}{\omega})^2}}$$

Résonance de vitesse

V_{max} est max $\rightarrow h^2 + \left(m\omega - \frac{k}{\omega}\right)^2$ est min

$$\Rightarrow m\omega - \frac{k}{\omega} = 0 \Rightarrow m\omega = \frac{k}{\omega} \Rightarrow \omega^2 = \frac{k}{m}$$

$$\Rightarrow \omega_R = \omega_0 = \sqrt{\frac{k}{m}} = 30 rads^{-1}$$